AMATEUR WORK

A MONTHLY MAGAZINE OF THE USEFUL ARTS AND SCIENCES.

Vol. I. No. 10. BOSTON, AUGUST, 1902. Ten Cents a Copy

HOW TO MAKE AN ASTATIC GALVANOMETER.

R. C. Browne.

The herein-described instrument if carefully made will be found extremely useful in detecting minute currents of electricity, and for use in connection with the Wheatstone bridge described in the last number of this magazine. It is so named because the arrangement of the needles is such as to neutralize the earth's magnetism. It is constructed on the principle that a wire through which a current is passing, will deflect a magnetic needle towards a position at right angles with the wire.

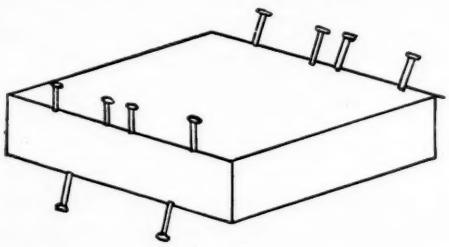


Fig. 1.

A small coil of cotton or silk covered magnet wire should first be made. About one-half ounce of No. 30 gauge, white preferred, will be required, and should be wound over a block of wood $1\frac{1}{2}''$ square and $\frac{3}{8}''$ thick. The ends should be smooth to facilitate the removal of the coil when completed. The coil should be wound so that the top layer will be divided into two sections, having the same number of turns in each section. This can easily be done by driving into the block before winding, twelve strong pins, or small gauge wire nails, as shown in Fig. 1. The outer pins in the top row are $\frac{3}{4}''$ apart, the inner pins $\frac{1}{8}''$ apart; the pins on the under side are $\frac{5}{8}''$ apart. No wire should be wound in the space between the inner pins of the top row. Wind the coils evenly and firmly by hand, leaving ends about 6″ long for connections. When the winding is completed, dip the coils in hot paraffin. When cool, but not

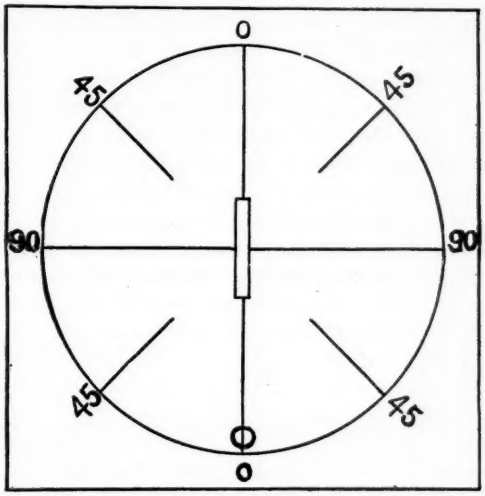


Fig. 2.

hard, remove the pins and lightly press the coils between two flat pieces of wood, to make them smooth and flat on the top and bottom. Then lay aside until the paraffin is quite hard, when the block is carefully removed.

The coil is mounted on a baseboard 7″ square and $\frac{7}{8}''$ thick, two binding-posts being placed 1″ from the corners on one side, and the ends of the

coil connected to them. The coil is attached to the center of the baseboard with sealing-wax, the divided part being on top.

A dial is next made of a piece of white cardboard 6″ square. With dividers draw a circle 5″ in diameter, then draw lines through the center at right angles, dividing it into four equal parts, as shown in Fig. 2. The ends of one of the lines mark O, the ends of the other 90°. Other divisions may be made at 15, 30, 45, 60 and 75°. Cut a slot in the center of the dial on the O line 1¼″ long and ⅛″ wide, and then attach it with sealing-wax to the top of the coil, so that the slot will be over the dividing space in the coil. Pieces of wood or cork may be cemented between the base and the dial, to more firmly hold the latter. Nails or iron should not be used anywhere in this instrument.

The support for the needles is made of a piece of ¼″ brass rod 10″ long. Bend 1½″ or 2″ of one end to a right angle, and to the short end affix a binding-post, either by soldering or by threading the end of the rod. The hole in the binding-post should be 2½″ from the longer section of rod. Make a ¼″ hole through the dial and into the baseboard, 2½″ from the center of the dial and on the O line, as shown in Fig. 2. Drive the long arm of the brass rod into the hole in the base, and through the hole in the binding-post on the other arm put a long, flat-headed brass nail. Place the arm so the brass nail is directly over the center of the dial.

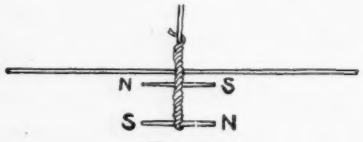


Fig. 3.

The needle magnets are next made. Two medium-sized sewing needles are required. Break off each end, using the center portions, which should be 1″ long. Use care to get them alike in size and length. They should be magnetized by winding wire around them and sending a current from a battery through the wire for a few minutes, or by rubbing them with a permanent or electro-magnet. The needles are then put through holes in a short length of fine straw, far enough apart so that when suspended they will just clear the coils, one needle being above and the other below the upper layer of the coils. In place of the straw, a stirrup of fine copper wire may be made by twisting it around the needles, the N pole of one needle being on the same end with the S pole of the other, and as evenly adjusted as possible. An index needle of fine brass wire 4½″ long should be put through the straw or stirrup, just above the upper needle, as shown in Fig. 3. The needles are suspended from the brass nail in the binding-post by means of a fine fiber of cocoon silk, or fine human hair attached to the straw or stirrup by a drop of sealing-wax, so that the lower needle will turn freely inside the coil and the upper needle just clear the dial without touching it.

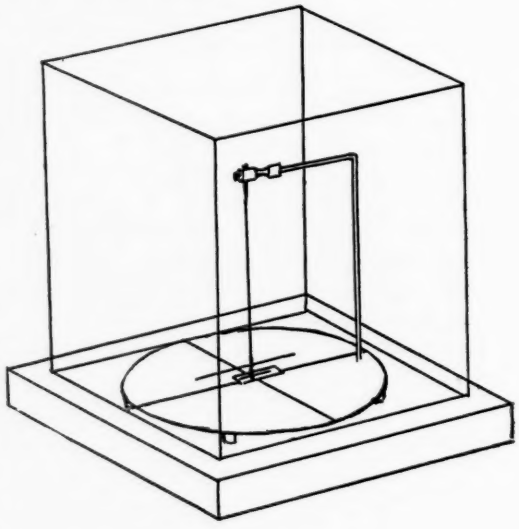


Fig. 4.

A glass case for covering the instrument may be made by taking four pieces of window glass 10″ long and 6″ wide, and one piece 6″ by 6¼″, and cementing them together with fish glue in the form of a box with one open end (see Fig. 4). Narrow strips of cloth or leather on the edges will add to the strength.

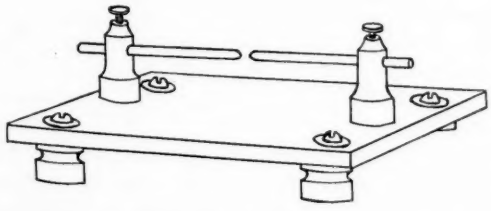
To test the instrument, when completed, twist pieces of iron and copper wire together at one end, connecting the free ends to the binding-posts

on the base. Upon holding a lighted match to the twisted joint, the electricity generated by this heat will deflect the needle. Even the heat of the hand is sufficient to produce a movement of the needle. A piece of copper in one hand and a piece of zinc in the other, applied to the binding-posts, will cause the needle to oscillate freely. In using the instrument the index needle must be adjusted by turning the brass nail so that it rests on the O line.

A LIGHTNING ARRESTER.

R. C. Browne.

The lightning arrester here described can easily be made, and will work well in connection with the wireless-telegraphy apparatus recently described in this magazine. To make it, procure a piece of thick roofing slate, or what is better, a piece of slate from a discarded icechest. It should be 4″ long and 2″ wide. Slate can be cut with an old saw, and the holes made with a diamond drill. Drill a $\frac{1}{8}$″ hole in each corner and two holes in the center, 3″ apart, the latter to receive the screws in the bases of two binding-posts. Enlarge the holes in the binding-posts to $\frac{1}{4}$″ diameter, and mount them on the slate with the holes facing each other. Two pieces of $\frac{1}{4}$″ brass or German silver rod, each 2″ long, are needed. Slightly



round one end of each piece, and then put them through the holes in the binding-posts with the rounded ends toward each other, but about $\frac{1}{4}$″ apart, as shown in the illustration. This space is suitable for the wireless-telegraphy apparatus. For other uses it may be lessened.

When made, the instrument is mounted at the point where the wire likely to be charged by lightning enters the building. Under the holes in each corner place small porcelain insulators, and secure to the house with round-headed brass screws. Use care in putting in the screws, as the slate is easily broken at the corners. When in place, connect one end of a heavy copper wire, No. 6 or larger, to the lower binding-post, the other end of the wire being carried on insulators to some good ground, such as a piece of sheet copper 1′ square, the wire being soldered to it. The copper plate should be buried deep enough to be in earth which is always moist. The overhead or line wire is connected to the other binding-post before it is carried to the telegraph instruments inside.

Any incandescent electric light will burn under water at any depth if the wires and the lamp are protected from getting wet.

The lifting power of any gas is the difference between the weight of the gas and the weight of the same volume of air. One cubic foot air at normal pressure weighs 1.29 ounces avoirdupois; one cubic foot pure hydrogen under the same conditions weighs 0.089 ounce avoirdupois. The difference is 1.2 ounces, which is the weight that one cubic foot of hydrogen will balance in the air. It will lift any weight less than that.

The Cauvery Falls electrical power transmission works in India, which have taken just under two years to construct, will be brought into operation this month, says the London *Electrical Engineer*. The plant is designed to generate 4,500 horse-power for transmission over a distance of more than ninety miles to the heart of the Kolar gold fields, where it will be distributed among ten gold mines, the best-known of which are Mysore, Ooregum, Nundydroog and Champion Reef. The transmission line, consisting of telegraph posts carrying six strands of copper wire, runs through extremely hilly jungles infested by the tiger, panther and bear, from which may be gathered some idea of the difficult nature of the work which had to be accomplished. The fact that the nearest railway station to the power station is some thirty miles distant, also led to considerable trouble in getting supplies, and tame elephants were requisitioned to help to convey the machinery from the railway to the center of operations. With the completion of the work this month, it is hoped that the greater part of the mining machinery on the Kolar gold fields will be worked by electricity.

AN ELECTRIC SHOCKING MACHINE.

WILLIAM SLYKE.

A STRONG "shocking machine" can be made from an ordinary electric bell in the following manner: Remove the gong from a good size electric bell and then screw the rest of the bell to a hardwood base of sufficient size to give a margin of 1″ on one side. Two holes are then bored in this margin, for receiving two binding-posts with screw base. To the arm from which the gong was removed screw a piece of fine magnet wire, twisting the other end to the screw of the nearest binding-post. One end of a similar piece of wire is twisted around the screw of the vibrator at A, Fig. 1, and the other end is twisted to the screw of the remaining binding-post, both of which can now be screwed down.

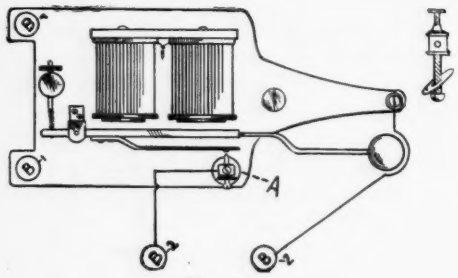


FIG. 1.

For the electrodes, two pieces of brass tubing about 3½″ long will be required. Make two wooden plugs to fit tightly in the end of each tube, boring a hole through the center of each plug large enough to receive pieces of flexible covered wire, each about 3′ long. Cut the covering from each end of the wire for about an inch. Push one end through the hole in one of the plugs, turn it back over and around the sides of the plug and carefully push the plug into one of the tubes, as shown in Fig. 2. The bare wire is thus in good contact with the tube. The other tube is prepared in the same way. The other ends of the wire are inserted in the holes in the binding-posts, using care not to force the screw too hard and so twist off the ends of the wire. With this arrangement the electrodes can easily be removed when not in use.

A battery of two or three dry cells in series is then connected by insulated copper wire to the binding-posts of the bell frame. Upon taking the electrodes, one in each hand, a powerful shock will be felt. A small one-point switch on one of

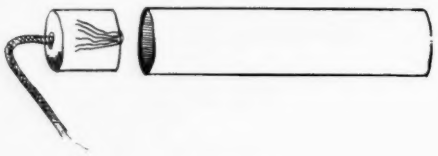


FIG. 2.

the battery wires will be found convenient to throw the battery out of circuit when not in use, and so avoid running it down, or one wire may be disconnected.

A regulator for changing the strength of the current may easily be made.

Procure a piece of glass tubing about 3″ long, with fairly thick walls, also two corks which will fit tightly in the ends of the tube. Two pieces of straight copper wire, one 1½″ long and the other 2½″ long, are each twisted on one end into loops.

FIG. 3.

Holes are punched in the centers of the corks to receive the wires, which should fit tightly. (See Fig. 3.) Put one of the corks into the tube, fill the tube nearly full of pure water and put in the other cork. Seal each end with sealing-wax, using care not to get any on the wire. Connect the regulator by soldering to one of the battery wires, and fasten to the base by strips of brass or leather. The regulation is secured by changing the position of the longer wire; the nearer the ends of the wire in the tube, the stronger the current. By increasing the space the current is reduced. The writer has a machine made in the way here described, which, with a battery of three cells, gives a current almost impossible to hold.

STUDIES IN ELECTRICITY.

X. THE DYNAMO.

In the last chapter the generating of a current by means of a dynamo-electric machine was briefly considered. The reversal of the direction of the current induced by the motion of the coil of wire, as illustrated in Fig. 25, is true of all the coils of wire comprising in part the armature of a dynamo. This is further illustrated in Fig. 26, which shows the ends of the wire coil C — C′ connected with two semicircular pieces of brass, A and B, representing the commutator, which are in contact with flat pieces of copper, E and F, representing

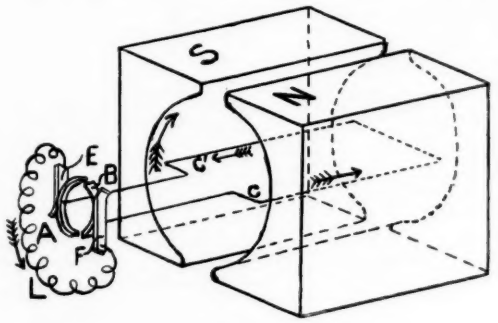


Fig. 26.

the brushes of a dynamo. Assuming that the coil of wire is revolving clockwise, and cutting the lines of force from the N to the S poles of the magnet, a current induced in the part of the coil C is in the reverse direction from that in the part C′, and only requires a closed circuit to flow around the coil in the direction shown by the arrows. As the coil continues to revolve until the position of the parts C and C′ are reversed, the current still flows around the circuit L in the same direction. The direction of the current in the coil has been reversed, but the pieces E and F are now in contact with different brushes, so the current still flows in the same direction around the main circuit. By having a large number of coils of wire in the armature and a corresponding number of sections in the commutator, the current in the main circuit is made practically uniform, the current from one coil rapidly succeeding that from the preceding coil.

In commercial dynamos the practice is to have from 24 to 50 coils, each coil having several turns of wire, or the equivalent to several turns, as, to save labor, several lengths of insulated wire are wound together and the ends soldered at the proper section of the commutator. The greater the number of coils the more uniform the current, but the size of the machine and its uses regulate the number that are mechanically desirable.

The sections of the commutator are insulated from each other by mica or other nonconductor.

In addition to the coils of wire in the armature of a dynamo is an iron core, the purpose of which is to make a good magnetic path for the lines of force passing through it from the N to the S pole of the field magnets, as the core concentrates these lines of force, so increasing the number cut by the coils of wire, and consequently increasing the efficiency of the dynamo. The magnets be-

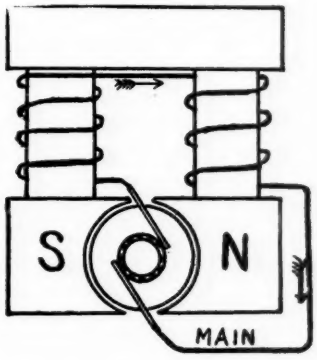


Fig. 27.

tween which the armature revolves are called the *field magnets*. The function of the field magnets is to provide the magnetic lines of force, through which the armature coils revolve. They may be permanent magnets or electro-magnets, the latter being universally used when other than very light

work is required. The reason for this is that electro-magnets are capable of giving a much more powerful current than permanent magnets.

In the earliest forms of dynamos the field magnets were excited by a current from an outside source; but this form was soon superseded by the self-exciting dynamo. One form, known as the *series dynamo*, is shown in Fig. 27. The iron cores of the field magnets, after being once excited, retain a certain amount of magnetism, termed residual magnetism. While small in amount, it is yet sufficient to produce some electro-motive force, so that when the armature revolves, a feeble current is produced, which, passing through the field coils, increases the magnetism, which, in turn, increases the magnetic lines of force and the resulting current from the armature coils. This continues until the armature core and field cores are thoroughly saturated with magnetism, and the dynamo reaches its maximum efficiency. By experiment and calculation the size and wiring of the several parts of a dynamo are carefully determined, tha the greatest output may be obtained from a given expenditure of power, and yet not reach a point where excessive or injurious E. M. F. is generated. The series dynamo is a form not much used, as it is not self-regulating under a varying load. If underloaded, the E. M. F. increases excessively; if overloaded, it decreases rapidly,—the reverse of which is desirable under those conditions.

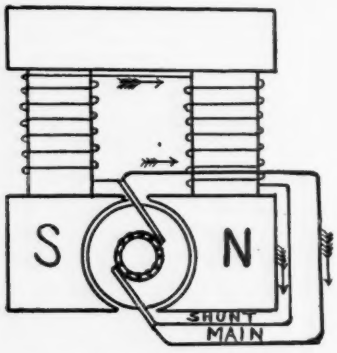


Fig. 28.

The wiring of the field coils is in series with the outside circuit, and the armature and the whole current passes through them. This necessitates a few turns of large wire for the fields. The load of a series dynamo is usually connected in series.

Another form of wiring which overcomes certain of the objections of the series dynamo is that known as the *shunt-wound dynamo*, shown in Fig. 28. In this type the field coils form a shunt to the main circuit, only a portion of the current from the armature passing through them. The current, therefore, is divided or shunted, the larger part going directly to the outside circuit, and the balance around the field coils. As this latter current is small in amount, the wire for the field coils of a shunt-wound dynamo is small in size, but consists of many turns. The magnetism produced by the field coils is proportional to the current and the turns of wire, *ampere turns*, as they are called. Thus 10 turns of a large wire carrying 10 amperes is the equal of 100 turns of smaller wire carrying 1 ampere, and each will exert the same magnetizing force. By reducing the size of the wire, the ampere turns of a shunt-wound dynamo is made equal to the ampere turns of a series dynamo of the same size. The amount of energy required to magnetize the fields, and the efficiency of the two types of dynamos under a normal load, should be the same.

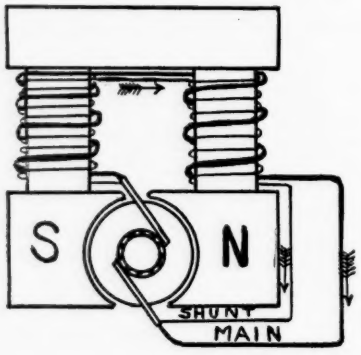


Fig. 29.

The shunt dynamo is more nearly self-regulating under a varying load than a series dynamo, the load being usually in parallel. Therefore, as additional branches in parallel in the main circuit are closed, the resistance falls, and more current

is supplied by the armature. This decreases the amount received in the shunt or field coils, thus reducing the magnetism, which in turn slightly reduces the current of the armature, and so regulates the output of the dynamo. A low resistance in the armature is desirable in this type, and also an even strength of magnetism in the fields. To regulate the voltage of a shunt dynamo, a rheostat is generally inserted in the shunt circuit. A rheostat is an instrument containing circuits of varying resistance, with a switch for disconnecting any or all of them.

Another type of dynamo which is self-regulating under wide variations of load is that known as the *compound dynamo*, shown in Fig. 29. This is a combination of the two previous forms of winding. In addition to the shunt winding of the fields, a few coils of thick wire in series with the main circuit are added. The effect of this is to make the current in the field winding, and consequently the magnetism produced proportional to the current flowing from the armature. The shunt winding maintains the proper voltage and the series winding the volume of current. It is customary, when using this form of dynamo for electric lighting work, to have the series winding slightly in excess of the theoretical requirements, that the voltage of the current may be fully maintained at all parts of the main circuit. This is called *overcompounding*. The various parts of the above types of dynamos will be more fully considered in subsequent chapters.

The great pendulum, weighing twenty-seven kilogrammes, installed by Léon Foucalt in the Pantheon to afford a proof of the rotation of the earth, will soon be in an experimental state after having been laid aside since May 3, 1832, under decree of Louis Bonaparte.

Many of the steam railroads of the country are fully awake to the growing importance of electrical transportation, and have organized electrical engineering staffs to study the question as it affects their interests. It is the wise management that takes up this problem now and keeps in touch with this branch of electrical development that is moving forward with such rapid pace.

ARE SHIPS' RUDDERS TOO LARGE?

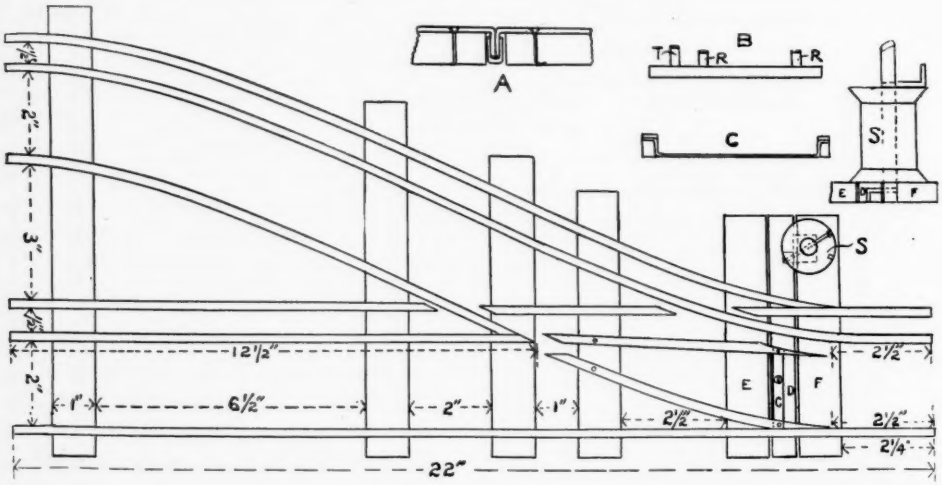
Have shipbuilders for years past been making the ship's rudder too large? If so, no man can estimate the thousands of tons of coal which have been wasted on our ocean steamer lines. The *American Shipbuilder* describes the discovery made by the late Captain Albers of the "Deutschland," who died suddenly while on his last voyage to Hamburg. While the speed of the "Deutschland" under the most favorable conditions had never before exceeded twenty-three and a half knots, Captain Albers observed upon this last voyage that she was logging twenty-five knots an hour, and for a full day was consistently maintaining that extraordinary speed. Investigation into the causes disclosed the fact that the vessel had lost all but a small portion of her rudder, and that thereby a considerable surface of resistance to the sea had been done away with. The result of this loss of resistance had been an increase of speed to the extent of, on an average, two knots an hour, and with no added expenditure of energy or coal consumption. In other words, a large vessel of the "Deutschland's" capacity, with a small rudder, it would seem to have been proven, could, without added expense, shorten in time the distance between port and port by something like two hundred miles. When, in addition to this fact, it was found that on the high sea the vessel was easily directed by the use of the twin screws for steering purposes, and that in the harbor and narrow waters of any port so huge a vessel could be steered with the assistance of the propellers, by a rudder which was a mere shadow of its former self, a principle seemed to be established which may work a revolution in the construction of the steering gear of our ocean greyhounds. There may prove to be, on further consideration, serious objections to the changes which the incident suggests, and what chance has appeared to demonstrate may in the cold light of reason and of experiment prove to lack permanent value, but the episode is an interesting one.

If it proves of enduring value it will not be the first time that sheer accident has resulted in the discovery of principles of great scientific importance, as well as of practical commercial value.

A MODEL ELECTRIC RAILWAY.

I. THE TRACK.

A MODEL electric railway probably affords more pleasure and instructive occupation for leisure time than anything which an amateur can make. Many of the readers of this magazine will undoubtedly be interested to learn how to make one which will work well and yet be inexpensive and simple in construction. The one here described is of this description, yet any one so desiring can elaborate these designs to quite an extent by putting in more detail than is here given. The system is that known as the "Third Rail," so named from a third rail which conveys the current to the motor, the track forming the return circuit. The parts to be described will include the track, switches, cross-track, bridges, turn-table, etc., also motor car and other rolling stock, and other fixtures of a regular railway. The aim in the preparation of these designs has been to keep the cost of making them at the lowest point consistent with serviceable results.



The materials for the track include several pieces of Venetian iron $\frac{3}{16}$" wide. This is sold by hardware dealers in coils of 50′ at fifteen cents. It is easily worked with drill and file, and with proper care no difficulty will be met in shaping it. It is fastened with small wire nails to strips of whitewood, maple, spruce or other suitable wood $\frac{3}{16}$" wide and $\frac{1}{4}$" thick. When the length of track has been determined, the necessary number of wooden strips can be ordered from any wood-working shop for a small sum. The pieces for the third rail are $\frac{3}{8}$" thick, and the strips for the sleepers should be $\frac{1}{2}$" wide and $\frac{1}{4}$" thick, with a few pieces 1" wide for switches and cross-track. A hand-drill will be needed for drilling holes in the iron for the nails, which should be about 4" apart. Fluted drills are better than diamond-pointed ones for this work; twist drills are too easily broken. Punching the holes is not desirable, as it bends the iron so much that it is difficult to get it straight again. Countersink each hole slightly with a drill of the size of the nail head.

To make a section of track, cut two pieces of iron, allowing $\frac{3}{4}$" extra length for the fastenings at the ends, and two pieces of wood for the rails, and a suitable number of pieces for the sleepers, which are spaced not over 6" apart, and as much closer as one may desire. Drill and countersink the holes for all the nails, bend $\frac{3}{8}$" of one end at a right angle, as shown at A, Fig. 1. Place the

same on one of the strips of wood and carefully nail with $\frac{3}{8}''$ wire nails, of the kind used in making cigar boxes, clinching the end on the under side. This prevents the nail from working loose. Do the same with the next hole, and then with a light hammer tap the rail until it is perfectly level. Continue until the whole rail is nailed and leveled, the other end being bent down for the joint, as previously mentioned. Then file down the heads of the nails until level with the track. But little filing should be required if the nails are the right size and the holes have been countersunk, and the rail should present a firm, level surface, well suited for even running of the cars. When both rails have been thus prepared, place them parallel and 2″ apart, with the iron on the under side; a 2″ gauge will probably suit most requirements, that is, 2″ between tracks. This allows the use of equipment made in Germany, and also by Carlisle & Finch, Cincinnati, Ohio, which is for sale in most of the larger cities throughout the country, and may be purchased by those desiring to do so.

The sleepers are $\frac{1}{2}''$ wide, $\frac{1}{4}''$ thick and 4″ long One running rail is placed $\frac{1}{2}''$ from one end of the sleeper, and the sleeper then carefully nailed to the wooden strip of the rail. The sleeper is then nailed to the other rail, the sleepers at the ends of each section being about $\frac{1}{2}''$ from the ends, as the wooden strips of the rails are liable to split if the sleepers are at the ends. A cross-section of the track is shown at B, Fig. 1; R R are the running rails, and T the third rail. The third rail is made in the same way that the others are, with the exception that ribbon brass $\frac{3}{16}''$ wide is used in place of the iron. This costs about thirty-five cents per pound, and one pound will do for about 50′ of track. Brass nails should be used for fastening to the wood, which should be about $\frac{1}{8}''$ higher than the track, so that the collector shoe on the motor car will not touch the track at switches and crossings and short-circuit the current. Sections of the third rail are joined with U-shaped pieces of brass, the ends of the third rail being bent over the same as with the iron rails. The third rail is placed $\frac{1}{2}''$ from the inside running rail.

In making curves and switches, the best results will be secured if a full-size pencil drawing is first made on manilla paper. To curve the iron or brass, hold it edgewise on two pieces of hard wood about 1″ apart, and hammer the upper edge until the proper curve is secured. After bending, it will probably be necessary to level it with a hammer, as previously directed. The wood for curves should be slightly green, as it bends better if in that condition, while well-seasoned wood will be more easily broken. The best way is to nail the curved iron or brass to a piece of wood of the proper thickness, and wide enough to permit surplus wood to be cut away with a fret-saw or drawknife, leaving only that needed for the rail. In this case the wood pieces are 8″ to 12″ long, and it will be found much easier to make curves this way than trying to bend long strips; but care must be used in driving the nails to avoid splitting the wood. The nails should be about 3″ apart on curves. If the curve is a sharp one, the rails may be fastened to a piece of thin board, instead of to sleepers.

The way to make a switch is clearly shown in Fig. 1. It will be noted that the outside rails are continuous, the inner ones being broken. The points are connected by a piece of the rail iron C, which is bent as shown at C, Fig. 1, the projection on each end fitting into a recess cut in the wood, and has a hole drilled through it. The nail which fastens down the iron rail goes through this hole. A hole is drilled through the center to receive a round-head screw, which fastens it to a piece of wood, D, which slides between the two sleepers, E and F. The other ends of the points are held by screws which are put through from the under side into the wood of the rails, holes being drilled in the sleeper to allow the screws to turn easily. A spool 1″ in diameter is nailed to the sleeper, as shown at S, a small square section first being cut out of both sleeper F and the switch-piece D, as indicated by the dotted lines. A wooden skewer is then cut to suitable length, and in the lower end, and also at the point where it projects above the spool, holes are bored to receive L-shaped pieces of steel wire. The lower one, moving in the slot in the switch-pieces, D, causes the latter to move whenever the upper one, representing the lever, is moved. To the upper end of the skewer is attached a small piece of wood, painted to represent a switchboard, and so

placed that when the switch is open it will be at right angles with the main track, or a block may be used to represent a switch light, green showing when the switch is closed, and red when it is open.

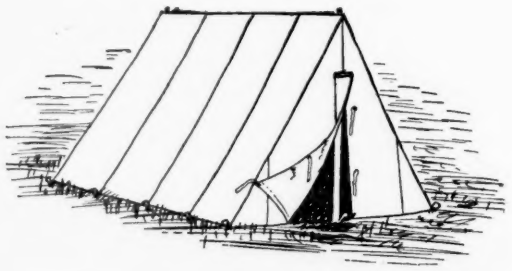
The outer ends of all rails are bent down as previously described, to form the joints with other sections. The ends of the third rail at switches and cross-tracks are depressed slightly, so that the shoe will pass over them without catching. Sections of the third rail at such places are connected by lengths of insulated wire, which should be soldered to the third rail. A blow-pipe will be the best for such connections, the rail and wire being first carefully cleaned with a file. Any inquiries that readers may find necessary will be answered through the correspondence department of this magazine.

HOW TO MAKE A TENT.

T. C. Prentiss.

A tent suitable for a small camping party or for children to play in can easily be made by any one who can run a sewing-machine. The shape here described is known as an A, or wedge, tent, 9 to 9½′ long, 7′ wide, and the pole 7½′ high. The dimensions will vary a little, due to the variation in the width of duck or drilling, either of which may be used, though duck is more serviceable and will shed rain better than drilling. The material used depends largely upon the service required. For ordinary shelter, drilling will answer nicely and is less expensive than duck. For a tent of the size above mentioned 31 yards of cloth 30″ wide are required. First cut four pieces 17′ long and sew them together with a lap seam ½″ wide, stitching each seam twice; that is, lay the edge of one piece of cloth upon the edge of a second piece, so that the edges overlap for ½″, and run the stitching ⅛″ from the edges of the cloth. Use heavy linen thread and a heavy machine needle, taking care to see that the overlays are in a uniform direction.

When the four strips are sewed together make the end pieces, the front one differing slightly from the rear one on account of the opening. For the rear end cut a piece 10′ 1″ long. Mark a point on one side of the piece 2′ 5″ from the end, and on the other side 7′ 7½″ from the end, and with a pencil draw a straight line between these points. Cut the cloth along this line. Put the long edges of the two pieces thus obtained together and sew with a ½″ lap-seam, as previously mentioned. Cut another piece of the cloth 2′ 5″ long and 14″ wide, and then cut this piece diagonally across to make triangular pieces, which should be sewed, one on each side of the two pieces previously mentioned, with a ½″ lap-seam. These four pieces form the back and are sewed to the sides with a ½″ lap-seam, the edges of the back being turned under the sides. All seams should be double stitched. The front is made in nearly the same way as the back, with the exception that the center seam is sewed last, and then only runs 1′ 7″ at the top, the remaining 6′ being open. A strip of the



cloth, 6′ 2″ long and 6″ wide, is hemmed on the right edge and at the top with a 1″ hem, and then sewed with a lap-seam to the center edge of the left strip, and at the top forming a fly opening. The front is then sewed to the sides with a ½″ lap-seam, the edges of the front being turned under the sides.

The bottom of the tent is then trimmed evenly, and a 1″ hem made around it. Through this hem, at each seam, cut small, round holes, and overcast the edges firmly with cotton twine. Similar holes are made in the top, 1″ from each end, through which project the iron rods in the upright tent poles. Pieces of clothesline about 15″ long are put through these holes and firmly knotted on the inside. These are used to tie to the tent pegs, to hold the tent upright. From waste pieces of the cloth make six strips 1″ wide and 12″ long, double thickness, and stitched along the edges, and fasten same, three on each side, to the inside of the open-

ing. These are used for tying on the inside at night.

The poles may be made of 2″ round oak curtain rods, or if these are not obtainable, spruce poles may be shaped with a draw-knife and plane from stock 2″ square obtained from a lumber dealer. In the latter case it is not necessary to make them round, octagonal will answer; in fact, military tent poles are often of this shape. The upright poles should be nearly 8′ long, the length of the cross-pole being obtained by carefully measuring the length of the tent. Tent-pole irons can be obtained from any large hardware dealer, who will order them if he has not them in stock. It would be well to order them along with the rest of the materials, to avoid possible delay. The irons needed are two iron rings for the cross-pole, with holes for the iron rods; two iron rings without holes, and two short iron rods for the upright poles. The iron rods are sunk for about one-half their length in holes bored in the upper ends of the uprights, and then the rings are snugly fitted on. The rings with holes are likewise fitted to the cross-pole, and holes bored through the pole to receive the iron rods. Be sure these holes are both bored through in the same line. By putting a small stick in one hole to indicate its direction, the other hole can easily be bored to match it.

To erect the tent, fasten one side to pegs in the ground, join the poles together, and put them flat inside the tent. Lift the poles and tent to an upright position, and holding the tent, pull out the other side to the proper place and attach to pegs previously driven in the ground.

THE announcement cabled from Europe a few days ago that Professor Marckwald of the University of Berlin had discovered a new element, is another link in a chain of discoveries which has been made chiefly by French and German scientists. Professor Marckwald is said to have separated a morsel of metal from uranium ore which emits radiation of a very active nature. The new metal, which evidently has not yet been named, has certain electrical properties, and is so very scarce that one gram of it is found in a ton of uranium ore. One might wonder how such an infinitesimally small amount of matter could have any wide significance, but it has, nevertheless, when taken in connection with other discoveries of a like nature. It concerns such an important matter as the production of light without heat and its commercial application.

ELECTRO-CHEMICAL reactions depend upon the fact that the salts of metals are dissociated when in solution. When potassium chloride is dissolved in water, what actually exists in the water is a succession of free atoms of chlorine and potassium, with great electrical charges. Similarly, when silver or gold cyanide is dissolved in potassium cyanide solution, the atoms are free; the weaker the solution, the more perfect such free condition. As soon as the atoms of gold or silver lose their charge of electricity (as they do when an electrical current is passed through), gold, with its ordinary properties, is at once produced and precipitates itself in the solid form.

A SHORT time ago it was stated that steps were being taken looking to the establishment of a system of wireless telegraphy on the Congo River in South Africa, as a result of experiments carried out in England at Withernsea. The London *Electrical Engineer* learns that fairly good progress has been made with the installation, but that the work has been greatly delayed by the loss of the vessel which was taking out some of the apparatus to South Africa. While awaiting the arrival of more material, however, the mast at Bahama has been fixed, and it is hoped to have the service in operation very soon.

SCHMIDT, in comparing the economical value of coal and electricity as sources of energy, arrives at the conclusion that on the average only 30 per cent of energy is utilized in the former case, whereas in the latter case this percentage is 90 per cent. For this reason he recommends that electrical heating be used in the manufacture of water gas, instead of the usual process of supplying the necessary heat by direct combustion under air blast. He bases his calculations on the economical conditions existing in Switzerland, and expresses the opinion that it would be easy to adapt carbide furnaces to the manufacture of water gas.

AMATEUR WORK

63 KILBY ST., BOSTON

DRAPER PUBLISHING COMPANY, PUBLISHERS

A Monthly Magazine of the Useful Arts and Sciences. Published on the first of each month, for the benefit and instruction of the amateur worker.

Subscription Rates for United States, Canada and Mexico, $1.00 per year. Single copies of any number in current volume, 10 cents.

TO ADVERTISERS

New advertisements, or changes, intended for a particular issue, should reach the office on or before the 15th of the previous month.

Copyright, 1902, by DRAPER PUBLISHING COMPANY

Entered at the Post-office, Boston, as second-class mail matter, Jan. 14, 1902.

AUGUST, 1902

Contents

		PAGE
How to Make an Astatic Galvanometer	*R. C. Browne*	227
A Lightning Arrester	*R. C. Browne*	229
An Electric Shocking Machine,	*William Slyke*	230
Studies in Electricity:		
X. The Dynamo		231
Are Ships' Rudders Too Large?		233
A Model Electric Railway:		
I. The Track		234
How to Make a Tent		236
How to Make a Kitchen Cabinet,	*John F. Adams*	239
Hammock Making	*E. H. Perkins*	
II. Canvas Hammock		243
III. Barrel Hammock		243
Photography:		
The Dark-room		244
Pin-hole Photography	*F. C. Baker*	245
A Folding Box-kite		247
A Summer Bungalow,	*Dr. C. Gilbert Percival*	248
Correspondence		250

Many readers of this magazine who are now enjoying their summer vacations have utilized a portion of their time in securing new subscribers, obtaining premiums, and thus adding many useful tools to their equipment. Undoubtedly there are many others who could profit in the same way, did they but make the attempt. The premiums offered for this work are all of excellent quality and well worth working for. Should any one desire any special tool not yet mentioned, by advising the publishers the same will be offered as a premium. In this way the present stock of tools can be supplemented by those most desired.

Our sincere thanks are extended to the many readers who, in their correspondence, have so warmly commended the magazine and expressed their appreciation of its contents. This evidence of the welcome which has been extended to it from all sections of the country, will serve as an added incentive, if any be needed, to make the future issues even more interesting than those already published. We are pleased to announce that several new subjects of general interest will be presented at an early date.

Several responses have already been received from our invitation to submit articles for the Amateur Work exhibit at the forthcoming exhibition of the Massachusetts Charitable Mechanics Association. This invitation is not confined to articles which have been described in the magazine, but includes anything which any reader has made, likely to be of interest to the general public.

The receipt of several excellent descriptive articles leads us to again call attention to the invitation previously extended to our readers to submit such articles, for which suitable remuneration will be given. They should be as complete as possible, and accompanied with the necessary drawings or photographs to properly illustrate them.

This number has been unavoidably delayed. The September number will be issued promptly on time.

HOW TO MAKE A KITCHEN CABINET.

John F. Adams.

One of the greatest step-savers for the housewife is a kitchen cabinet, and but comparatively few know its value. It places within easy reach all the necessary utensils and articles needed for the larger part of the cooking, is easily kept clean, and can be located or moved so as to afford an abundance of light. The cabinet described here, while seemingly a rather elaborate piece of furniture, is easily made by any one having ordinary skill in the use of woodworking tools. For convenience in describing, the work will be divided into two parts: the base and the cupboard. The general design of these two parts is shown in Fig. 1. The base contains a large bin for breadflour on the right, a compartment for cooking dishes and pans on the left, two large drawers on the right end for sugar and flour, and a large front drawer for knives, spoons, etc. At the right, even with the top, a bread or meat board, in the form of a drop leaf, gives additional space.

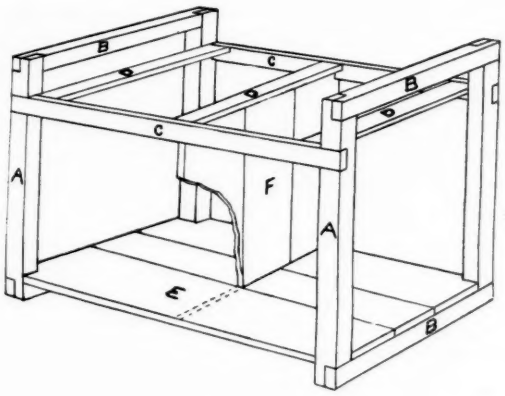
The upper part, or cupboard, has a molding-board which drops down and exposes three shelves for spices and other supplies. Over this is another compartment with two doors. In the upper right corner is a closet with a door, and below this two or three drawers, as preferred,—the design showing three,—in which articles in bulk may be stored. The wood used for the outside work may be oak, cypress or whitewood. Unless an experienced woodworker, either of the two latter kinds had best be used, only be sure to get thoroughly dried stock.

The first work in the construction of the base is the frame shown in Fig. 2. This requires four corner posts, A, 30″ long and 2″ square; four crosspieces, B, 27″ long and 2″ square; two crosspieces, C, 36″ long, 2″ wide and $\frac{7}{8}$″ thick; three pieces, D, 25$\frac{1}{4}$″ long, 2″ wide and $\frac{7}{8}$″ thick; matched boards to cover floor, E, 30″ long, 27″ wide and $\frac{7}{8}$″ thick, and additional matched boards for partition, F, 21″ high and 27″ deep; also, for an additional partition not shown, between the drawers and the flour-bin, which is 21″ high and 17″ deep. The frame may be made of any suitable wood other than pine, which is too soft. For the flooring and partitions whitewood or pine may be used. The construction of the frame is clearly shown in Fig. 2, so no detail directions are necessary. The top of crosspiece C is 4″ below the top of posts A. The piece D, over the partition F, is centered, and simply nailed through pieces C. The outer pieces D are nailed snug up against the posts A, and form the ledges for the drawer. The floor E is nailed to the bottom piece B, and the partition F is nailed at the top through the piece D and at the bottom through the floor. The joints for posts A and pieces B are "halved," and pieces C are mortised into posts A. These joints should all be well made, and care used to erect the frame perfectly square, that the drawers and doors will open easily. Strips of wood 1″ square and 25″ long should be nailed to the end pieces D, about 30$\frac{7}{8}$″ apart, to hold the drawer in position when closing it.

The frame being completed the casing will be considered,—that for the right end varying a little from the left. The method of joining is shown in Fig. 3. The pieces G are 30″ long, 2$\frac{1}{2}$″ wide and $\frac{7}{8}$″ thick, the left one being grooved on the inside the whole length; the right one having a mortise 5$\frac{1}{2}$″ long at the top, 3$\frac{1}{2}$″ long at the bottom, and another 2″ long, centered between those on the ends.

The piece J is 2″ wide and 20″ long, not including the tenons at top and bottom, which are each $\frac{1}{2}$″ long, making the length of this piece 21″ over all. The left side has a groove running the whole length; the right side has a mortise corresponding to the one in G. A second piece of the same dimension as J, with grooving on both sides, is also required, as will be seen from Fig. 1. Two panels of $\frac{1}{4}$″ stock are required for the right end and three for the left end. They are 21″ long and 6$\frac{1}{8}$″ wide for right end, and 6$\frac{5}{8}$″ wide for left end. The piece H is 6″ wide and 22$\frac{1}{2}$″ long, with $\frac{1}{2}$″ tenons on each end, and grooved on the under side. The piece I is 4″ wide and 22$\frac{1}{2}$″ long, with $\frac{1}{2}$″ tenons on each, and grooved on the upper side. The grooving can all be done

at the lumber mill at little expense if, when the order for the lumber is given, the pieces to be grooved are specified. When all the pieces are cut out and accurately fitted they are put together, being firmly glued, and held tight with clamps while the glue dries. If no regular clamps are available, temporary ones may be made by screwing two blocks of wood to a strong, level board, far enough apart to allow a wedge to be driven in between one block and the frame. When completed the size should be such that, with the left side even with the front of piece A of the frame, the inside of the right piece G should be even with the inside of the post A of that corner, thus allowing the drawers to be easily fitted. The left end is made the same as the right, with the exception that a panel takes the place of the drawers, and the pieces G and J are grooved for the extra panel. Additional drawers may be made on the left end if desired, but the capacity of the cupboard in front will be just that much less.



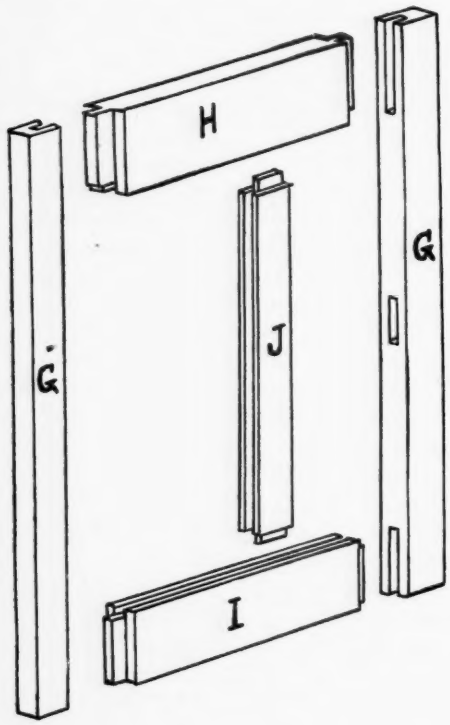
The front is easily made. The two upright pieces on the ends are 30″ long and 3½″ wide, with mortises, 4″ from the top, 2″ long for the tenons on the crosspiece under the drawer. (See Fig. 1.) At the bottom ends 4″ mortises are made. The crosspiece under the drawer is 2″ wide and 30¾″ long, not including the tenons on each end, ¾″ long, making 32¼″ over all. The bottom crosspiece is the same length and 4″ wide, with tenons. In the center of each crosspiece make 2¾″ mortises for the upright centerpiece between the cupboard and flour-bin, which is 2¾″ wide. The ends and front being completed, they are fastened to the frame with some 2″ wire nails of small gauge. Nail and glue the ends to the frame, and then the front, strongly gluing and nailing the joints between the front and ends. Any roughness of the joints should be carefully removed with a plane. This done, make the door of the cupboard and front of the flour-bin, the two being alike and are 20″ high and 14″ wide. With the experience already gained in framing, these will be easily made. The upright pieces are 20″ long and 2½″ wide; the crosspieces 9″ long, with ½″ tenons on each end, making them 10″ over all. Both upright and cross pieces are grooved on the inside edge for the panel pieces, which are of ¼″ stock, 14¼″ long and 9¾″ wide. They should be well glued together, using clamps as previously directed for all glued work whenever possible to do so.

The drawer is 30¾″ long, 4″ deep, and 18″ or 20″ wide. The front piece is rabbeted on each end to receive the side pieces, only about ¼″ of wood being left on the front side. The side pieces are nailed into this rabbet, the rear ends of side pieces having a ¼″ rabbet for the back piece. A ¼″ rabbet is run around the lower edge of all the pieces, to receive the bottom pieces. This makes a firm drawer, which will retain its shape. Use care to see that, when cutting out and fastening together, the work is square.

The flour-bin is at the front, the height of the door 20″, but at the back only 14⅞″. The side pieces are 10¼″ wide, with curved top, as shown, and the back piece 14″ wide, and should be of smooth, clear stock ⅞″ thick. The lower ends should have a rabbet ¼″ deep for the bottom board, which is 12¾″ x 10¾″. The bin should be well glued, and nailed with wire nails, that the weight of the flour when it is full will not force it apart. It swings on two strong brass hinges at the bottom, and is held at the top by a small piece of wood which is screwed to the under side of piece C of the frame, after the hinges are on. The door to the cupboard has two brass hinges at the left side and a catch on the right. Two draw pulls are desirable for the drawer.

The two drawers on the end are 9″ high, 6½″ wide and 15″ long. They are framed the same as the front drawer, but have, in addition, a face board of ½″ stock, which is firmly glued to the front

board of the drawer. It overlaps the front board $\frac{1}{4}''$ on all sides, and the outside edges are made quarter-round, to add to the appearance. Strips 1″ square are nailed to the partition on the left and framework on the right, to form ledges for the drawers.



The top of the cabinet is 40″ long, 30″ wide and $\frac{7}{8}''$ thick. Clear, well-matched boards should be used, and preferably should be tongued and grooved, but may be simply glued up. Care should be used to see that the joints on the top side are perfectly even, and any projecting edges should be taken off with a plane after the glue is thoroughly dried. The top is nailed and glued to the piece B of the frame, projecting evenly at each end and front.

The drop leaf on the right is 18″ long, 12″ wide and $\frac{7}{8}''$ thick. The ends should have cleats with tongued and grooved joint. Two hinges are screwed to the under side, fastening it to the top. It is held up when in use by a strip of wood 10″ long, 2″ wide and $\frac{7}{8}''$ thick, with a hinge at the upper end, the lower end resting on a triangular block, as shown in Fig. 1. Each end of this piece is beveled to fit well, the angle of bevel being best determined by trial.

The back is sheathed with $\frac{1}{2}''$ matched sheathing nailed to the floor and the back piece C. A 1″ square strip may be nailed to the under side of the top, and the sheathing also nailed to it, making a tight joint between top and back.

With strong castors — preferably the kind having a flat plate, and attach with three screws — the base is complete and ready for the cupboard, although it may be used without the latter.

The general plan of the upper section, or cupboard, is shown in Fig. 1. The boards for the sides are 33″ long, 12″ wide and $\frac{7}{8}''$ thick; for the partition between the drawers and shelves, another piece $\frac{7}{8}''$ less in length. The top is 40″ long, 13″ wide and $\frac{7}{8}''$ thick; the bottom 37″ long, 12″ wide and $\frac{7}{8}''$ thick. The piece under the double closet on the upper left side is 26″ long, $11\frac{1}{2}''$ wide and $\frac{7}{8}''$ thick. The two shelves back of the drop leaf are 26″ long, $10\frac{1}{2}''$ wide, and $\frac{3}{4}''$ or $\frac{7}{8}''$ thick. The three pieces over the drawers on the lower right side are $9\frac{3}{8}''$ long and $11\frac{1}{2}''$ wide. The top, sides and bottom pieces should have $\frac{1}{2}''$ rabbets on the back to receive the sheathing. Careful nailing with wire nails will answer for this part of the cabinet. The top projects 1″ on each end and in front. The bottom piece is fitted to $\frac{3}{8}''$ rabbets in the bottom of the two side pieces. The upright partition is $9\frac{3}{8}''$ from the right side piece. The three pieces over the drawers on the right side are $4\frac{1}{2}''$ apart. The crosspiece over the drop leaf is 21″ above the bottom piece. The shelves back of the drop leaf are 7″ apart between centers, but may be otherwise spaced if preferred, giving more space to the lower ones. The drop leaf, which forms the molding board, is 26″ long and 21″ wide. This will probably have to be made up by gluing, with 2″ clamps on each end, which should be tongued and grooved. A 2″ strip may be nailed on top of the lower edge, that flour will not be spilled into the cupboard back of it. The doors of the upper left cupboard are each 12″ wide and $12\frac{3}{8}''$ high, the frame for them being $2\frac{1}{2}''$ wide, with grooving $\frac{3}{8}''$ deep on the inside for the panels, which are $7\frac{5}{8}''$ by 8″, and $\frac{1}{4}''$ thick. This

makes the upright pieces 12⅜″ long, and the crosspieces 7¾″ long, allowing ⅜″ on each end of the latter for the tenons.

A piece 2″ wide divides the two doors. The door to the cupboard on the upper right side is 19″ high and 9⅜″ wide; the side pieces for the frame being 19″ long and 2″ wide, and the top and bottom pieces 6⅛″ long and 2½″ wide, allowing ⅜″ on each end for tenons, with grooving ⅜″ deep on the inside of each piece for the panel, which is 15¾″ by 6⅛″.

The three drawers on the lower right side are 9⅜″ wide, 4½″ deep and 10″ long, outside measurement. The front and back pieces are rabbeted on the ends for the side pieces, and on the lower edges for the bottom pieces, and are well glued and put together with wire nails. With the necessary hinges and catches in place, the cabinet is now complete, with the exception of staining or other finish, which is left to the fancy of the maker. While there is considerable work in making such a cabinet, it is not at all difficult, if proper care is used. It is one of the most useful pieces of furniture that can be added to the household, and only requires to be used to be thoroughly appreciated.

HAMMOCK MAKING.

E. H. Perkins.

II. CANVAS HAMMOCKS.

Hammocks made from this material are by many people considered the most satisfactory. A stout piece of denim may also be used if a colored hammock is desired. They may be made with or without a stretcher, but when one is used it is placed inside the hem at each end and sewed in. A curved is better than a straight stretcher.

To make a comfortable hammock a stout piece

of canvas 6′ long and 3′ wide is necessary. If the material is not wide enough, make a seam in the center by overlapping the two selvages ½″, and stitch each edge flat to the cloth. The sides and ends are hemmed. A small rope or cod line placed inside the hem on each side gives additional strength. The hems at the ends are 3″ wide, and in the middle of each are placed the eyelet-holes, which are made for the leaders, or clews, as they are called on navy hammocks. There are twenty-four eyelet-holes on each end, at equal distances apart. A small ring, made of closely woven cord about ⅛″ in diameter, is placed in each eyelet-hole and thickly sewn over all the way around with twine. The leaders may be made of cod line or any stout line, and should be about 3′ long. Two rings similar to those used in the netted hammocks are needed.

To make the leaders pass the line through the first eyelet-hole, making a stout knot at the end, which must be on the under side of the hammock. Pass the leader through the iron ring, which should be placed 3′ from the eyelet-hole, and make a tight knot at the ring. Carry the line to the second eyelet-hole and cut off the line, leaving enough to make a stout knot, which, like the first, must be on the under side of the hammock. Pass the line through the third eyelet-hole, making a knot on the under side, then through the iron ring with a tight knot and into the fourth eyelet-hole, cutting and knotting as in the second eyelet-hole. Continue until all the eyelet-holes are filled, and the hammock is done.

III. Barrel Hammocks.

A barrel hammock has the advantage that rain does not harm it, and there is therefore no necessity to take it in every night, as with most hammocks. Sugar barrels are the best to use, but almost any barrel will answer. Two barrels are

needed, as twenty-four or twenty-five staves are used in an ordinary-sized hammock.

Break the barrels apart carefully, and after removing all the nails, smooth the edges of each stave with a draw knife or plane. This done, bore a hole $\frac{5}{8}$″ in diameter 2½″ from each end of the staves.

For supporting the staves, 80′ of quarter-inch rope or strong clothesline will be required. This rope is divided into four lengths of 20′ each. Taking two of these pieces, tie them together with a strong knot 4′ from the ends. Pass the loose ends through the hole in the end of one of the staves, one through the upper side and the other through the lower, pulling the cords through until the stave is firm against the knot. Give the cords a half-twist and then pass them through the hole of the second stave; the rope which passed downward through the first stave now passes up through the hole in the second stave, and the other rope reversing to correspond. Continue lacing each successive stave in the same manner, with the half-twist between each, and tying a firm knot outside the last stave.

Lace the staves on the other side in the same way.

The loose ends of the ropes are then spliced to a strong iron ring, although knots may be tied if the maker does not care to take the time for splicing.

A coat of enamel paint will add much to the attractive appearance, and will enable it the better to withstand exposure. A piece of an old comforter covered with pretty cretonne or denim, with flounces to hang over the sides, and a pillow to match, makes a comfortable and pretty addition.

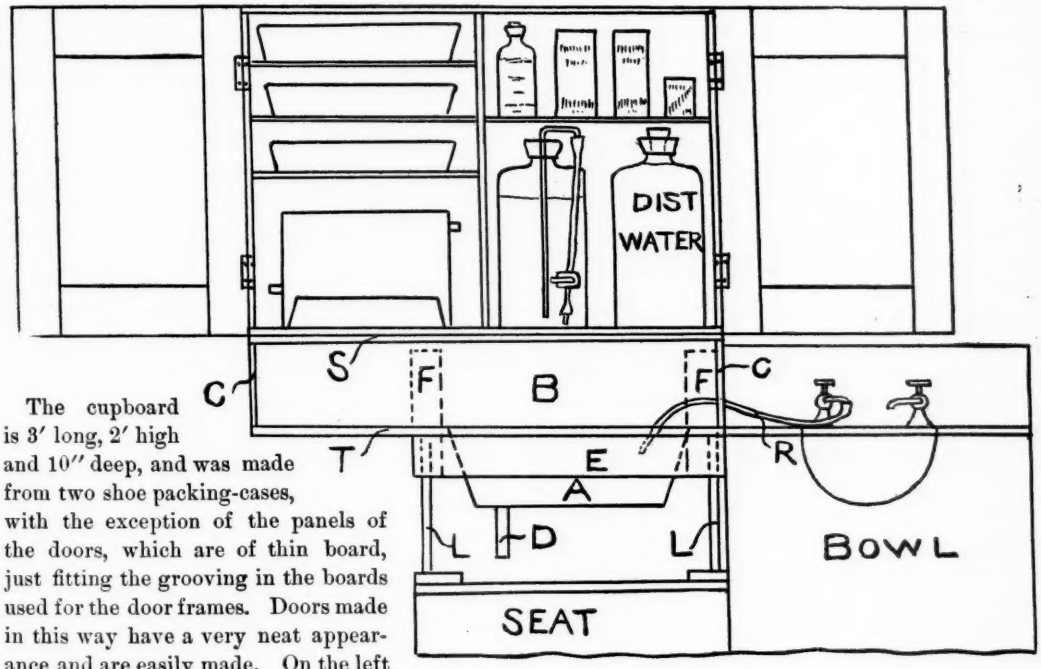
PHOTOGRAPHY.

THE DARK-ROOM.

The dark-room, to the amateur, is frequently a difficult matter to secure, if the appointments are to be handy of access and use. If a bathroom is available, a little work and a small expenditure for materials will enable one to have a room which will allow day or night work to be readily done without inconvenience to the rest of the household, or "slopping around," which would make it objectionable. The great advantage in using a bathroom is that water, the prime necessity of photographic work, is already at hand, and a little rubber tubing or piping is all that is necessary to make it available. The arrangement here described is adapted from a similar one, designed to be quickly put in place and removed. In the bathroom where it is used the seat and bowl are adjacent, so the sink, A, is mounted on short legs which rest upon the woodwork of the seat, as shown in the illustration. If the plumbing is open, the framework should have legs reaching to the floor. The sink is porcelain lined, 24″ long, 18″ wide and 6″ deep, but other sizes may be used. A short length of lead pipe, D, allows it to drain into the bowl underneath.

The framework, E, was made from the pine boards of a packing case, the top, T, being made as level and smooth as possible. It measures 36″ long and 24″ wide. At the back an upright board, B, 10″ wide, is well fastened by two cleats, F, 3″ wide and 15″ long. Square pieces of board, C, at each end of the back board support a shelf, S, 10″ wide, upon which the cupboard is placed when in use. Only general dimensions are here given, as the arrangements of bathrooms vary, so that anyone desiring to make a similar equipment will of necessity be obliged to make it in accordance with the room to be used. The flanges of the sink rest in a hole of suitable size cut in the

top, T, of the frame. The running water is conducted by a short length of rubber tube, R, of a diameter which allows it to be easily slipped over the end of the faucet. In winter another piece of tubing allows warm water to be used for heating solutions, etc.



The cupboard is 3′ long, 2′ high and 10″ deep, and was made from two shoe packing-cases, with the exception of the panels of the doors, which are of thin board, just fitting the grooving in the boards used for the door frames. Doors made in this way have a very neat appearance and are easily made. On the left side of the cupboard are three shelves for trays and a larger place for the wash-box. On the right side one shelf in the upper part gives a place for small bottles and chemicals, and below is room for two large bottles for distilled water. One of these bottles is fitted with a syphon, which is easily made as follows: A heavy glass tube with two bends at the top is put through a rubber stopper, the latter having a second hole in it, fitted with a short length of glass tube to admit air when drawing the water. This is closed with a plug when not in use. The inner end of the syphon tube reaches nearly to the bottom of the bottle, the outer end having a rubber tube attached which is long enough to reach the sink when the bottle is placed on top of the cupboard. The lower end of the rubber tube is also fitted with a short length of glass tubing, and also near the end with a pinch cock for controlling the flow of water. The syphon is easily changed from one bottle to the other by removing the stopper. The glass and rubber tubing can usually be purchased of a druggist. The wash-box when in use is placed in the sink or on the right side of the top of table, connected with the rubber tube from the faucet and the water allowed to run as long as desired. The framework was painted first with white lead paint and then with white enamel paint, which allows all chemicals to be quickly wiped up, and also makes the various articles in use more conspicuous in the dim light of the room.

PIN-HOLE PHOTOGRAPHY.

"F. C. Baker in Western Camera Notes."

One of the most interesting phases of photography to the amateur who happens to be of an experimental and pottering turn of mind is pin-hole, or, as it is called by Mr. J. B. Thomson, the author of the clever and exhaustive monograph on the subject in the *Photo-Miniature*, "lensless" photography. There seems to be a peculiar

fascination connected with the production of pictures without the aid of the lens, so generally looked upon as the all-important and indispensable feature of a photographic outfit; and when the resulting negatives and prints are of an excellence such as to make them compare favorably with the results obtained by the employment of a good lens, the experimenter experiences a glow of satisfaction and a feeling that he has achieved something worthy in spite of unfavorable conditions and primitive apparatus.

It is not certain, however, that this feeling is entirely warranted by the facts, for we should place the credit for successful results where it is due, and there seems to be no reason to doubt that a pin-hole, if well made, is for certain pictorial qualities and purposes a really very efficient instrument.

Among its good qualities may be mentioned the fact that the image produced is absolutely truthful, unlike that formed by even the best lenses.

Another good feature of the pin-hole camera is that there is no necessity for focusing: the image is in focus at all distances between pin-hole and plate that will be required for general use, and the angle of view is varied by simply varying that distance, and thus obtaining at will extreme narrow angle effects as well as anything desired between the two.

This advantage will be found to be at times an important one, as, for example, in architectural work, when several exposures may be made under varying conditions and from different viewpoints, and just the most appropriate angle selected for each case without further trouble than changing the distance between plate and aperture of the camera.

And then the cheapness of it! If you are not the possessor of a camera already, all you need do is to get a cigar box, make it light-tight, rig some arrangement for inserting the plates conveniently, and fit the front of the box with a bit of thin metal pierced by a tiny hole, and you will have, at practically no expense, an outfit which, if intelligently used, and with due regard for its limitations, will enable you to produce the very best of work.

To one who already has a camera, the fitting of it for pin-hole work is a very simple matter.

If the camera is one with a removable lensboard, an extra one may be made, carrying the pin-hole and substituted for the regular lens-board.

A shutter is not a necessity, as the exposure may be made either by pulling and replacing the slide of the plate-holder or by keeping the front of the camera covered, say by the focusing cloth, until the slide is pulled, and then recovering the front with the cloth while replacing the slide.

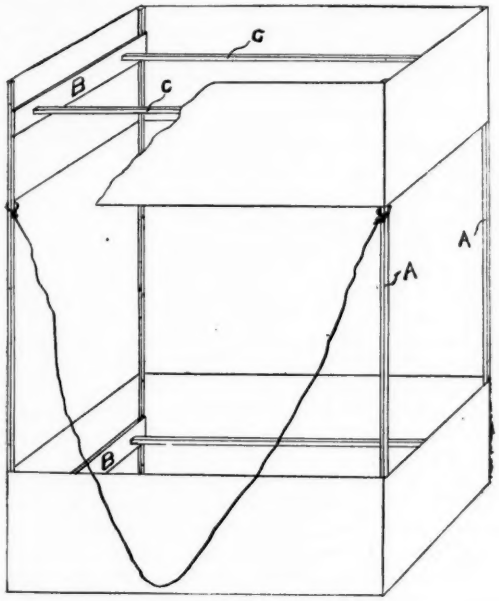
My own experience has been with a 5 x 7 long-focus bellows camera, fitted as above described, and while I have not, of course, discarded the lens, I have found much pleasure and satisfaction in the employment of my extra lens-board, and would not think of leaving it behind when starting on a picture-hunting trip.

Of course the making of the pin-hole itself is an important matter, and care should be taken to get it perfectly round and its edges as smooth as possible. I used a needle. I do not know what number, but it was about an inch and a half long, and only the point was used in piercing the thin copper. The needle point, after being driven by light blows of a hammer through the copper, was inserted in the hole thus made, first from one side and then from the other, and twisted about. One of the results of this procedure was to raise a portion of the metal in the form of a burr at the edge of the hole, and this was shaved away with a sharp knife, and the twisting operation gone through with again. Then more shaving and twisting alternately until the hole seemed perfect, even when examined under a magnifying glass. The side of this small copper sheet that was to be placed towards the inside of the camera was then blackened by being held for a moment in the flame of a match. My extra lens-board was made of several thicknesses of cardboard, cut to fit exactly the opening in the camera front, and built up to the proper thickness by pasting the pieces together. A hole about one-half inch in diameter was cut in the center of this board, and the pin-hole attached by pasting with strips of black paper sufficient to insure the front's being perfectly light-tight.

THERE are now 8,660 less horses than five years ago in New York City. Trolley cars and autos did it.

A FOLDING BOX-KITE.

A BOX-KITE is one of the most entertaining forms of kite which can be made, and is of special value in wireless telegraphy where a pole is not available. A very convenient size, with a pull which will not be tiresome in a moderate breeze, is 30″ high, 20″ wide and 9″ deep. Four pieces of light, strong wood are required for the corner posts, A, 30″ long and $\frac{1}{4}$″ square. Four pieces of thin wood, B, 9″ long and 2″ wide, are carefully nailed to the posts A, 3″ from the ends. The side pieces of a long cigar-box are suitable for these pieces. In the center of the pieces B, and $1\frac{1}{2}$″ from the ends, cut holes $\frac{1}{4}$″ by $\frac{1}{8}$″, to receive the ends of the pieces C. The crosspieces C, $19\frac{1}{2}$″ long and $\frac{1}{4}$″ square, have tenons cut on the ends to fit the holes in the pieces B.



FOLDING BOX-KITE.

The covering consists of two bands of light, firm cloth 58″ long, not including the extra cloth required for the seam, and 9″ wide. The seam should be stitched on a machine, using care to have it square with the edges. To erect the kite, place the bands on each end of the frames, with the crosspieces B on the inside, and then put in the crosspieces C. These should require some bending, but should be nearly straight when in place, so that the cloth belts will be stretched taut and the surfaces remain flat when in the air. The seams of the belts should be at the corners, and the belts should be adjusted until all the angles of the kite are square. The belts are then tacked to the posts A with small tacks. A loop of strong, light cord 6′ long is then tied to front posts A, just below the lower edge of the upper band. The line is then tied to the center of the loop and the kite is ready for flying. If the kite dives, or does not fly properly when well up in the air, adjust the loop until satisfactory results are secured. Smooth-finish mattress twine is the most desirable for kite-flying, having great strength for the weight. It may be purchased at most upholstering places. For wireless telegraphy a larger kite of the same proportions, but with fine piano wire for the line, may be used, the instruments being connected when the kite has reached an altitude where it remains steady. The wire should be wound on a reel made from a large wooden twine-spool mounted on a wooden base, which may be fastened to the ground by wooden tent-pegs, care being taken to see that the wire does not touch the ground. Do not use the wire upon the approach of or during a thunderstorm.

VIOLINS and mandolins made of clay are now being placed on the market in Europe and America. Many declare them to be superior to the time-honored wooden instruments. The clay is made into a high-grade porcelain, which forms the body of the mandolin or violin. The porcelain body, it is claimed, is better capacitated for producing sound than a wooden one, since it co-operates in the making of sound, causing the notes to become soft and full. A further advantage claimed is that the porcelain instrument is totally insensible of the influence of the weather.

A SUMMER BUNGALOW.

Dr. C. Gilbert Percival in the Brown Book.

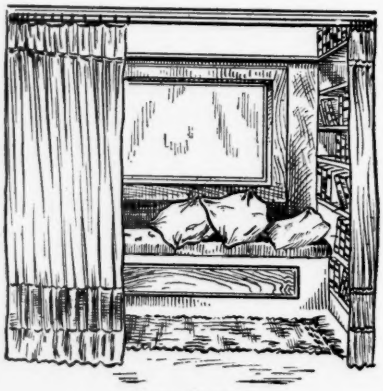
It is because a great many persons suffer themselves to live in stifling cities throughout the hot weather, who, if they did but know it, could possess an attractive summer home for a mere song, that I am prompted to tell herewith how I recently built a pleasant and enjoyable little affair of a cottage that did not cost me over one hundred dollars.

First of all, select your land. Whether it be by lake, pond, river, bay or shore, or whether you buy or lease it, be sure of three things. These are: that first it is in a healthful district, free from malaria; second, that there is pure drinking water available, and thirdly, that it can be easily reached from your business.

A Summer Bungalow.

After having seen to all three of the above, then proceed to the erection of your house. Select a knoll or elevated spot, and here clear and level away the ground for the foundation of your summer abode. Sills of 4 x 5 timber are strong and sufficient. If there are any available stones or rocks, you can use some to put under your sills, but they are hardly necessary unless your site is very sandy I consider a house of 18 x 14′ just about as big as needed, though the size can be varied to suit the individual fancy and requirement.

This summer camp I am about to describe is a fair example of what can be done for less than one hundred dollars. By referring to the ground sketch, it will be seen that the small camp, or shanty, as I call it, is capable of comfortably housing a small family, there being two sleeping rooms. If more beds are required, the couches running around three sides of the camp can be turned into beds at night, they being 30″ wide. There are two ample verandas 8′ wide and 20′ long, each placed so that some portion of it catches the breeze, no matter from which direction it comes.



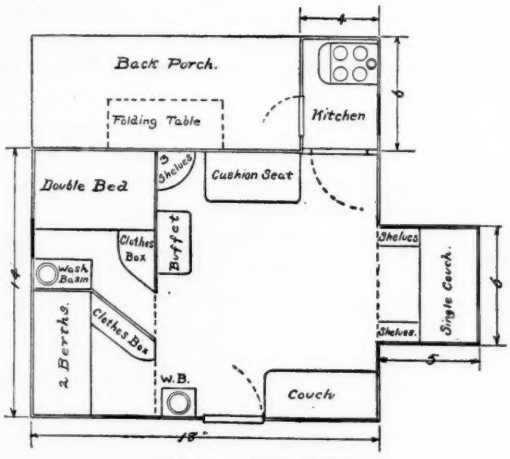
Cosy Corner.

Build your cottage near where your well is to be dug, as the shorter distance you have to carry the water the better. In my own case I have rigged up a trolley arrangement, by which I can run a pail down to the well by its own gravity, fill it and return it to the cottage without much exertion. Water for toilet purposes is furnished from a homemade tank, on the roof of the kitchen. The extermination of insect pests is another important consideration. The cheapest form of exterminator is sulpho-napthol or even pure carbolic acid. When you are applying your heavy roofing paper to sides, floors and roof before shingling or clapboarding, you will find if you will paint lightly or brush over with a strong solution of sulpho-napthol, thoroughly saturating the paper, that you will never be bothered with insects. It drives away ants and is sure death to fleas. Before putting down a matting in the cottage, paint the floor with a strong solution of sulpho-napthol or carbolic acid. The odor goes away in a few days, but the death-dealing properties stay in the wood and matting. In the kitchen and on the verandas paint the walls with a hot solution of alum (2 ounces of alum to the pint of water) and you have banished all fears of cockroaches, water bugs, ants and moths.

As can be seen by reference to the floor plan, there is a bay on one corresponding to another bay on the same side, which is used as a kitchen. This kitchen is separate from the rest of the camp by an arrangement of

two doors, which is very important in keeping the most generally obnoxious odors of cooking and the heat from the rest of the house. The other bay projects onto the veranda and can be fitted with a broad couch and shelves for books and magazines, as per sketch, and with a portière or two at night can be converted into a very cosy and comfortable sleeping-room for extra guests.

The kitchen has a large sink, a good cupboard for utensils, and can be entered from the side veranda, which in pleasant weather can be used as a dining-room, it being far more preferable to eat out of doors on the cool veranda in hot summer weather; and for this purpose I have provided my house with a table 7′ long, which, when not in use, is hinged so as to fall flat against the side of the house out of harm's way, and giving free use of the veranda for hammocks and easy-chairs.



PLAN OF BUNGALOW.

To those who contemplate building a summer residence similar to the one described in this article, the following statistics as to cost and materials may not be amiss:

MATERIALS AND COST

MATERIAL	QUANTITY	COST
Hemlock boards	1,000 ft.	$18.00
Pine boards	400 ft.	9.00
Framing lumber	500 sq. ft.	10 00
Flooring lumber	400 ft.	8.00
Shingles	4,000	10.00
Laths	1,000	1.00
Canvas	30 yds.	3.00
Paper	2 rolls	5.00
Nails	25 lbs.	2.00
Hardware		2.00
Paint		2.00
Windows	5	5.00
Sinks	3	3.00
Incidentals		6.00
Carpenter's wages	1 week.	16.00
Total		$100.00

As can be seen by the plan, every inch of the available room is taken advantage of, and some very unique bedrooms are the result. The principal bedroom is 6′ 6″ in width and 11′ long. In this, without crowding, is placed a 4′ bed, a washbowl with running water drawn from a rain cistern on the roof, a clothes-closet 6′ long by 2½′ wide, and another one over 2′ long by 2′ wide. This room has one window opening over the washbowl, and is really the most comfortable room in the house. The next room adjoining is for the children, and is 6½′ square and contains two beds, each 30″ wide, arranged one over the other, like a steamship stateroom.

The partitions between the general rooms and the sleeping-rooms are made of light canvas nailed over laths.

For boarding I prefer hemlock, because it is cheap and easily handled. These should be covered with heavy building paper, which is both wind and mosquito proof, and then clapboarded. The roof can be done with the same, the paper being given a coat of paint before shingling. I have shingled my entire cottage, treating each shingle with creosote stain and the whole a coat of moss-green stain. For my floor I use first a floor of hemlock, then a covering of heavy building paper, and then a floor of hard pine laid the other way across.

REAR ADMIRAL ROGERS and the naval board, of which he is chairman, have selected a site for a government wireless telegraph station on the Navesink Highlands. The tower is to be placed near the north beacon of the famous Twin Lights and close to the Postal Telegraph Observatory.

ACCORDING to *Electricity*, a novel departure in boat-race reporting was introduced last month by F. B. Howard, the agent of the Associated Press in Poughkeepsie, N. Y., with the co-operation of the Hudson River Telephone Company. Mr. Howard and Manager Rupley of the telephone company were on board of the judge's boat at the finish, with a telephone connected by under-water cable with the telegraph station of the Associated Press at the finish line on shore. In this way the positions of the crews crossing the line and the official time were telephoned to the shore, and immediately telegraphed all over the country. The telephone was also used to receive the progress of the crews as they came down the course, and this information was megaphoned from the judge's boat to the yachts anchored in the neighborhood. It was a very clever arrangement, and successfully carried out.

CORRESPONDENCE.

OUR readers are invited to contribute to this department, but no responsibility is assumed for the opinions expressed in these communications.

Letters for this department should be addressed to Editor of AMATEUR WORK, 63 Kilby Street, Boston.

They should be plainly written on only one side of the paper, with a top margin of one inch and side margins of one-half inch.

The name and address of the writer must be given, but will not be used, if so requested.

Enclose stamps, if an answer is desired.

In referring to other letters, give the number of the letter referred to, and the date published.

Illustrate the subject when possible by a drawing or photograph with dimensions.

Readers who desire to purchase articles not advertised in our columns will be furnished the addresses of dealers or manufacturers, if stamp is enclosed with request.

(No. 17.)

BUFFALO, N. Y., June 29, 1902.

Can you tell me who manufactures steam engines and boilers of ¼, ½ and 1 H. P. A. M.

B. R. Wicks, Bridgeport, Conn., and Sipp Electric and Machine Company, Paterson, N. J., make such engines, and the latter firm make boilers. They will send circulars and prices upon application.

(No. 18.)

ALBANY, N. Y., July 11, 1902.

In the article descriptive of an "Electric Wind Vane," a steel rod is used as an axis for the vane. As this part of the instrument is put on top of the house, would it not be dangerous in case of thunderstorms? If so, can you tell me a way to avoid the trouble?

W. S.

Little fear need be felt that lightning will be attracted by such a small rod as is required for the weather vane. A lightning arrester can be added if desired, a description of one being given in this issue of the magazine.

(No. 19.)

CAMBRIDGE, MASS., July 11, 1902.

Will you please tell me where and at what price a wire gauge can be purchased? V. J. B.

A wire gauge, English standard, 5 to 36, list price, $1.00; American standard, 5 to 36, $2.00. You should be able to get such gauges at any large hardware store. If desired for electrical wire, you should get the American gauge.

(No. 20.)

ANTIGO, WIS., July 7, 1902.

Please inform me the weight of wire required for the primary and secondary coils of the medical coil described in the February issue. K. G. M.

About one-half pound of each size will be required for the coil.

(No. 21.)

BOSTON, MASS., July 22, 1902.

I have completed the spark coil which was described in the June number, but cannot make it work satisfactorily. The amount of current passing through the secondary coil was very light. It was even so small that one would have to place the wires on his tongue to be able to detect the current. Please advise what I may do to improve it. E. A. W.

First test the primary coil, and if this is found to be all right, there is undoubtedly a break somewhere in the secondary coil. It may be in the leading-out wires, as these are quite likely to get broken when mounting the coil. If a careful examination does not locate the fault here, the best thing to do is to rewind the secondary, making careful tests of the wire before doing so. Several readers of the magazine have made these coils from the directions given, and are getting good fat sparks over an inch long, one reporting a spark over 1½" long.

NOTICE.

ROBERT THISTLEWHITE, Dover, Morris County, N. J., writes that the sets of motor castings offered free to readers of this magazine, who should write for them, were so quickly applied for that the supply became exhausted. Another supply will soon be ready, and all requests on file will be filled.

THE *Electrical Review* says: "The fact that the rooms of the King of England were cooled and ventilated during his severe illness by means of the electric fan was deemed of sufficient interest to be cabled to numerous daily papers in this country. The electric fan is purely an American invention, and its usefulness is becoming more and more appreciated in all countries."

AN invention which is likely to revolutionize the watchmaking industry has been perfected by a Swiss watchmaker, David Perret of Marin, near Neuchatel. It is a watch which goes by electricity. It was severely tested by experts, and it was found that it gained only seven-tenths of a second in five weeks. The expert at the observatory at Neuchatel declares the watch to be equal in precision to an expensive chronometer. The watch resembles an ordinary gentleman's lever, and will run, so it is claimed, fifteen years without being rewound.